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AFFILIATION OF NAVY VETERANS WITH THE SELECTED RESERVE

Martha E. Shiells

A Division of CNA Hudson Institute

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AFFILIATION OF NAVY VETERANS WITH THE SELECTED RESERVE

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A Division of CNA Hudson Institute

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ABSTRACT

This paper analyzes the factors that may influence the decision of first-term enlisted Navy veterans to join the Selected Reserve. A model of the determinants of affiliation is developed and estimated using data on active Navy separations and Reserve accessions from 1979 to 1985. Unique features of the model and estimation are that they combine all forms of pay into one variable, incorporate demand constraints, adjust for simultaneity between bonus eligibility and affiliation rates, and use a more comprehensive data set than has been available before. Affiliation is found to depend on Reserve pay, unemployment rates, geographic area, race, sex, paygrade, and Navy rating.

EXECUTIVE SUMMARY

With the growth of the Navy to 600 ships, the question of how the ships are to be manned has become increasingly important. In addition, Congress has asked the Navy to expand the role of the Naval Reserve. As a result, over the past several years, the Reserve has been assigned new missions and has been increasingly integrated with the active forces. An important consideration in transferring units to the Selected Reserve (SELRES) is the availability of personnel. SELRES units face unique manning problems because Reservists are part-time, voluntary employees who must train near their homes and who do not have time for extensive training. Reserve units, therefore, must draw on local sources of personnel, and many of these people must be pretrained.

The major source of qualified, pretrained personnel is the pool of recent Navy veterans (NAVETs) who live close to a Reserve unit. Market conditions, such as pay and unemployment rates, and personal characteristics, such as age, education, sex, and race, will affect how many veterans choose to affiliate with SELRES in any geographic area. In this paper, an empirical model of the determinants of enlisted NAVET affiliation rates is developed and estimated using a unique data set describing veteran accessions. Separate estimates are obtained for each of 11 rating groups defined by Department of Defense (DOD) one-digit occupational category. Only veterans who are lost near the end of their first term, who are eligible to reenlist, and who are not in ratings where SELRES affiliations are constrained by demand are included in the estimation.

The results indicate that there are significant, positive relationships between affiliation rates and both Reserve pay and civilian unemployment rates. The estimated pay elasticities for Reservists are comparable to typical estimates of pay elasticities for active Navy retention rates. The pay elasticities vary among rating groups but not among census regions. The

range of significant pay elasticities is from 0.77 for construction ratings to 1.95 for administrative and clerical ratings. On average, over all the rating groups with significant results, the current $300 annual affiliation bonus results in almost three extra SELRES accessions for every 100 typical first-term veterans. Elasticities of affiliation rates with respect to unemployment rates are significant in 10 of the 11 rating groups and range from 0.31 to 0.90. For example, the estimated unemployment rate elasticity for the medical ratings implies that if the unemployment rate in 1985 had increased by 10 percent, there would have been 1 additional SELRES accession for every 100 typical, eligible, first-term hospital corpsmen leaving active duty.

Although responsiveness to pay does not appear to vary across regions, affiliation rates do differ between some census regions in some rating groups. Affiliation rates seem to be the lowest, and not significantly different, in the East North Central, East South Central, and Pacific regions. The Middle Atlantic region seems to have somewhat higher rates, and the New England, West North Central, South Atlantic, West South Central, and Mountain regions seem to have substantially higher affiliation rates.

Other results include higher estimated affiliation rates for women, nonwhites, and persons who advance to higher paygrades during active duty. In some cases, the estimated affiliation rates for women and nonwhites are twice as high as the rates for typical white male NAVETs. The results for paygrade suggest that more rapid advancement during active duty increases the chances of SELRES membership. Finally, in some cases, accession behavior varies between ratings within occupational groups, even after adjusting for measurable differences in the economic opportunities, personal characteristics, paygrade mix, and regional distribution of the NAVETs in the ratings.

This study indicates that changes in regular military compensation and affiliation and reenlistment bonuses will influence the Navy's ability to attract and retain SELRES members. Also, periods of high inflation rates

or low unemployment rates will make the SELRES recruiting environment more difficult. Although they are outside the scope of the study, support is lent by analogy to such policy tools as unit incentive pay and Selective Reenlistment Bonuses for Training and Administration of Reserve (TAR) personnel. The results here also suggest that in forecasting affiliation rates, changes in the regional, rating, sex, and racial composition of the pool of eligible NAVETs should be taken into account. The results in this paper therefore should be of use in models that forecast SELRES strength attainability by rating and geographical area.

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INTRODUCTION

With the growth of the Navy to 600 ships, the question of how the ships are to be manned has become increasingly important. In addition, Congress has asked the Navy to expand the role of the Naval Reserve. As a result, over the past several years, the Reserve has been assigned new missions and has been increasingly integrated with the active forces. An important consideration in transferring units to the Selected Reserve (SELRES) is the availability of personnel. SELRES units face unique manning problems because Reservists are part-time, voluntary employees who must train near their homes and who do not have time for extensive training. Reserve units, therefore, must draw on local sources of personnel, and many of these people must be pretrained.

The major source of qualified, pretrained personnel is the pool of recent Navy veterans (NAVETs) who live close to a Reserve unit. To know whether it is possible to man a Reserve unit, it is important to know how many NAVETs live in the area and how many of them can be expected to join SELRES. A common technique is to use past observed affiliation rates as forecasts of future rates. The problem with this approach is that if there is a change in anything that influences accession behavior, then future affiliation rates will diverge from historical averages. In particular, market conditions, such as pay and unemployment rates, and personal characteristics, such as age, education, sex, and race, will affect how many veterans choose to affiliate with SELRES in any geographic area. To predict future accessions more accurately, it is therefore necessary to estimate the effect of changes in various determinants of affiliation rates.

One particular controversy over the determinants of affiliation behavior involves how responsive SELRES members are to pay. In 1970, the Gates Commission estimated that, for all services, SELRES enlistment elasticities with respect to pay would range from 0.8 to 1.25. An elasticity of 0.8 implies that a 1-percent increase in pay would induce an 0.8-percent

increase in enlistment rates. Thus, the Commission believed that Reservists would respond to pay in making enlistment decisions, but to a lesser extent than their active duty counterparts. This assumption was based on research on civilian workers in which it was found that monetary incentives are less important in "moonlighting" labor markets than in primary labor markets. Others, for example [1], argue that Reservists are not sensitive to pay because Reserve employment is more like participating in a patriotic, voluntary association than working a part-time job. Survey evidence from 1978 suggested that the pay elasticity for Reservists is only 0.2.

In this paper, an empirical model of the determinants of enlisted NAVET affiliation rates is developed and estimated using unique data on veteran accessions. The model used here resembles the model of active Navy retention developed in [2]. In particular, it differs from other studies (for example, [3], [4], and [5]) in the manner in which military pay is measured. Here, total annual drill pay for a certain paygrade and length of service is combined with annual affiliation bonus payments, and this sum is then adjusted for inflation. The implicit assumption is that an extra dollar of pay will have the same effect on the probability of affiliating, whether that extra dollar comes from higher drill pay, higher bonuses, or lower price levels. The advantage of this approach is that it increases the variation in the pay variable, and pay effects can be estimated more precisely. The empirical model also adjusts for differences in affiliation behavior caused by the lack of demand for certain ratings, and for simultaneity between bonus eligibility and affiliation rates.

The data used in this study are more recent and more extensive than those that have been available previously. The data describe individuals who left active duty between 1979 and 1984, and whether or not they join SELRES by 1985. To have a consistent measure of affiliation behavior, one-year affiliation rates are used, that is, affiliation occurring within one year of leaving active duty. The scope of the investigation is limited to first-term enlisted NAVETs who are eligible to reenlist. Considering only first-term separations means that retirement pay is not a necessary part of

the calculations. Also, the behavior of NAVETs should be different from that of Active Mariners, Sea and Air Mariners, or others who have a legal obligation to join the drilling Reserve.

The first section that follows explains the model and estimation technique used and how demand constraints and simultaneity bias are treated. The second section discusses in detail how the data set is constructed and gives statistics that describe the sample. The third section gives the results of the estimation, and a final section presents some general conclusions.

EMPIRICAL MODEL

In the model developed, a Navy veteran is assumed to affiliate with the Selected Reserve if he derives greater utility from participating in SELRES than he does from having more leisure time or from working a part-time civilian job. The model takes into account not only pecuniary motivations, but also employment conditions that affect the veteran's level of satisfaction. A derivation of the model of NAVET behavior that will be used, which resembles the model described in reference [2], is given in appendix A. In this model, the utility derived from joining SELRES is assumed to equal annual SELRES wages plus the monetary equivalent of the nonpecuniary aspects of SELRES employment. Note that a SELRES member's wages equal the wages from his full-time civilian job plus the wages he earns in the Reserve. Similarly, nonpecuniary benefits and costs are associated with both his full-time and Reserve employment. If the NAVET does not join SELRES, his utility equals the wages from and the monetarized nonpecuniary aspects of his full-time job and his part-time civilian job, if he moonlights.

Affiliation occurs if the utility of joining exceeds the utility of not joining. If the same full-time civilian job is worked whether or not one joins SELRES, then the wages from that job affect the utility of joining and not joining symmetrically. Thus, full-time civilian wages should not influence the probability of affiliation.[1] One implication of this specification is that affiliation probabilities do not depend on income levels. If Reserve employment is more attractive to persons with low incomes, then the model is specified incorrectly. This misspecification is unavoidable, however, because no good measures are available of veterans' civilian incomes. The best that can be done is to include variables that are correlated with income levels, and this procedure is part of the estimation method used. Income is

[1] As is discussed in appendix A, this statement is true only for a restricted set of utility functions. In particular, the marginal utility of income must be independent of both income and leisure.

correlated with such included variables as sex, race, paygrade, rating, education, mental group, and region. Thus, the estimated coefficients of these variables will include some of the income effect, and any possible bias in the estimates of pay and unemployment elasticities will be lessened.

Assuming a logistic distribution for random errors affecting utilities implies the following specification for the probability of affiliation:

$$\ln \frac{P_A}{(1-P_A)} = \beta_0 + \beta_1(WRES - WPT) + \beta_2 Z + \beta_3 JCFT + \beta_4 JCRES + \beta_5 JCPT + u, \quad (1)$$

where

P_A	=	probability of affiliation
$WRES$	=	wages from Reserve employment
WPT	=	wages from part-time civilian employment
Z	=	matrix of personal characteristics
$JCFT$	=	characteristics of full-time job
$JCRES$	=	characteristics of Reserve job
$JCPT$	=	characteristics of part-time job.

A feature of this model is that, regardless of where an extra dollar of income comes from, it is expected to have the same effect on affiliation. That is, an extra dollar of Reserve wages would increase the probability of affiliation by the same amount that an extra dollar of part-time civilian wages would decrease the probability. Furthermore, all sources of Reserve earnings, in particular drill pay and affiliation bonuses, are assumed to have the same effect on affiliation. This assumption is reasonable, given the manner in which bonuses are paid. The affiliation bonus is $25 per month for each remaining month of obligated service that is served in SELRES. Since those in eligible ratings can also receive reenlistment bonuses, the bonus payment amounts to $300 per year. The exact timing of the payment has varied so that more than $300 may be paid in a lump sum upon affiliation. The amounts and the time periods are small enough, however, that the discounting problem can be ignored.

The advantage of including all sources of pay in one variable is that it increases the precision of the pay elasticity estimate. To the extent that different sources of pay affect affiliation behavior differently, however, the results of the estimation presented below are biased. The assumption would be inappropriate if, for example, an extra dollar of bonus pay is worth more to the veteran than an extra dollar of drill pay because the bonus is paid in a lump sum upon affiliation. If this is the case, then the probability of affiliation will increase more per extra dollar of bonus pay than per extra dollar of drill pay. The estimated coefficient on the sum of both pays would then understate the sensitivity to bonus pay and overstate the sensitivity to drill pay.[2]

SPECIFICATION OF VARIABLES

To estimate equation 1, the variables in the vectors of job and personal characteristics must be specified. Unfortunately, very little information is available on the characteristics of individual NAVETs' civilian and SELRES jobs. Furthermore, no data are available on individual earnings in part-time civilian jobs. The only characteristic of civilian employment that is explicitly included is the unemployment rate, since the possibility of finding a civilian job as a substitute for SELRES participation depends on the unemployment rate. As the civilian unemployment rate increases, the probability of accepting a SELRES position should increase.

The Navy rating is then used as a proxy for expected moonlighting earnings, as well as for characteristics of civilian and SELRES employment. To the extent that moonlighting pay and job characteristics vary for NAVETs

[2]Another example would be if civilian earnings are perceived to be more variable than Reserve earnings. In this case, the probability of affiliation might decrease less per extra dollar of civilian earnings than it would increase per extra dollar of Reserve pay. The estimated coefficient on the difference between the pays would then overstate the sensitivity to civilian pay and understate the sensitivity to Reserve pay.

in the same rating, there is still a problem with omitted variables. Ratings are grouped using the one-digit Department of Defense (DOD) occupational categories, as given in table 1. If all three-letter rate abbreviations with the same first two letters fall within the same occupational category, then they are considered to be the same rating. For example, STG and STS are redefined as the ST rating. The affiliation probability equation is estimated separately for each rating group, and within rating groups dummy variables for all except one rating are included. The asterisks in table 1 indicate which rating dummy variables are omitted — in each case, that for the largest rating within the group. The implication is that, between rating groups, preferences, civilian job opportunities, and job characteristics are so different that not only affiliation rates vary, but also responsiveness to changes in pay, unemployment rates, and other explanatory variables. Within rating groups, however, it is assumed that only affiliation rates differ between ratings. This assumption has proven reasonable in other studies [2 and 3] and is not tested here. [3]

Personal characteristics that may affect tastes for military or civilian part-time employment, and thus affect the probability of affiliation, belong in the matrix Z. Personal characteristics may also influence civilian job opportunities or be correlated with income, and thus affect the probability of joining SELRES. Among the personal characteristics that should be included in the model are sex, race, age, marital status, education, and ability. Whether women have higher or lower affiliation rates depends on preferences, civilian job opportunities, and income effects. If women prefer not to moonlight because of family obligations, then women will have lower affiliation rates than men. On the other hand, if women have limited civilian job opportunities, then higher affiliation rates would be expected. Also, if women generally have lower incomes, and if low income increases the probability of SELRES membership, then higher affiliation rates would be expected. Race, age, and marital status would have similarly ambiguous effects on SELRES affiliation.

[3] Including rating dummy variables also controls for the problem of simultaneity between bonus eligibility and affiliation rates. This problem is discussed in more detail later.

TABLE 1

RATING GROUPS BY ONE-DIGIT DOD OCCUPATIONAL CATEGORIES

1	Seamanship	BM*, GMG, QM
2	Electronic equipment repair	AQ, AT, AX, CTM, DS, ET*, FT, MT, ST, TD, TM
3	Communications/ intelligence	AC, AW, CTI, CTO, CTR, CTT, EW, IS, OS, OT, RM*, SM
4	Medical	DT, HM*
5	Other technical	AG*, DM, EA, MU, PH
6	Administrative/ clerical	AK, AZ, CTA, DK, DP, JO, PC, PN, RP, SK, YN*
7A	Mechanical equipment repair —Aviation	AB, AD, AE, AM*, AO, AS
7S	Mechanical equipment repair —Surface	BT, CM, EM, EN, GMM, GMT, GS, IC, IM, MM*, MN, OM
8	Craftsmen	BU, CE, EO, HT*, LI, ML, MR, PM, SW, UT
9	Service/ supply	MS*, PR, SH
10	Unrated	AN, CN, FN, SN*

Note: The asterisks indicate the largest rating within each group and the variable that will be omitted in the estimation.

Ability and education play complex roles in the theory of affiliation behavior. Although there may be some relationship between ability, education, and tastes for Reserve service, the primary importance of these variables is most likely on the job opportunities, job characteristics, and income levels available to more highly educated, more able persons. A previous study [3] found that the mental group distributions of NAVETs who join and do not join SELRES are similar. Further, NAVETs have a mental group distribution that is above that for active Navy personnel, and considerably above that for the total population. Thus, the population of Navy veterans available for SELRES affiliation is already selected in terms of ability. Within this population, individuals of higher ability can obtain more attractive civilian jobs, but they can also expect a better career path in the Reserve. The net effect of ability on affiliation, then, is not certain. In this study, three measures of ability are included in the matrix Z. Intelligence is measured by Armed Forces Qualification Test (AFQT) scores, and educational level is measured by whether the person is a high school graduate.[4]

In addition, previous research on active Navy retention [4] has used paygrade as a measure of ability. Paygrade was found to affect retention probability to a greater extent than would be expected due to the higher pay associated with higher paygrades. Those who advance more rapidly presumably have different tastes for military service. A similar relationship might be expected between paygrade and preferences for

[4] A further complication is that no direct measure of ability is available. Test scores, such as the AFQT, measure ability with some amount of error. Education level, in particular whether an individual is a high school graduate, is also an imperfect measure of ability. Using proxies for ability will in general yield estimates of pay and unemployment effects that have less bias, but higher variance, than if ability were omitted. This may not be the case, however, if some of the variables that are included in equation 1 as determinants of affiliation probabilities also affect AFQT scores and educational attainment. In this case, the use of the proxy will not necessarily reduce the bias in estimates of other coefficients in equation 1 ([6], pages 158-162).

Reserve membership.[5] Paygrade will to some extent replicate the information contained in Reserve pay, since those in higher paygrades receive higher drill pay. It is feasible, however, to include both drill pay and paygrade in estimating equation 1. The relationship between paygrade and drill pay is not linear, so they exhibit some independent variation. This should make it possible to separate the effects on affiliation of higher pay as opposed to more rapid advancement.

Affiliation rates may also differ between geographical areas. Preferences for military participation may be stronger in some areas. Reserve jobs may have different characteristics in coastal areas. Part-time civilian jobs may be easier to find, or have more pleasant working conditions in some areas.[6] Average incomes may differ by region. For these reasons, variables indicating in which region the veteran lives are included in in the vector of personal characteristics, Z. It is possible that geographic area does more than shift affiliation probabilities up or down. It could also be that the coefficients on pay and other variables in equation 1 differ between geographic areas. If this were the case, then not only would veterans in some regions be more likely to affiliate, but they would also respond to changes in pay differently. On the other hand, if coefficients are believed to be the same in all regions, then more efficient estimates of the coefficients can be obtained by pooling all regions. Statistical tests are reported later that indicate that pay elasticities do not differ between census regions.

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[5]The relationship between paygrade and the probability of affiliation may be complex. It could be that persons who intend to continue their military career in the Reserve after separation from active duty are more likely to go through the process of qualifying for a higher paygrade. Alternatively, persons who leave active duty in spite of having attained a high paygrade may have less desire to continue their military careers.

[6]State unemployment rates are used in the estimation, so only geographic differences other than in unemployment rates will be captured by the regional dummy variables.

DEMAND CONSTRAINTS

Observed affiliations are not always good measures of the available supply of NAVETs. In particular, in some ratings over some periods of time, not all veterans who wish to join SELRES are allowed to do so. The lack of demand for certain skills may constrain the number of accessions. If past experience in these ratings is used to forecast possible NAVET accessions when the growth of SELRES has removed demand constraints, the results will be unnecessarily pessimistic. Demand constraints are discussed in [7] and [8], where it is shown that the Reserve Recruiting and Manning Objectives System (RAMOS) imposes an important constraint. Ratings in which manning is 101 to 110 percent of requirements are placed in RAMOS category D, and ratings that are over 110 percent manned are placed in category E. Recruitment into such ratings can occur only with special permission from COMNAVRESFOR.

Coefficient estimates will be biased if based on observations that reflect demand constraints. In particular, sensitivity to pay and unemployment will be underestimated if veterans are prevented by demand constraints from joining SELRES when pay or unemployment rates increase. The solution that is suggested in [7], and that is used below, is to omit from the sample observations that occur when a rating is classified RAMOS D or E. Since no rating group has all observations taken when all ratings were closed, it is possible to estimate coefficients using only unconstrained observations. The estimates are probably better, however, for rating groups in which fewer observations are demand constrained. Information on how demand constraints are incorporated and what percentage of observations are demand constrained is presented later in the Data section.

BONUS ELIGIBILITY AND AFFILIATION RATES

The pay variable, $WRES$, in equation 1 contains all forms of compensation paid to the Reservist. Both Reserve pay and affiliation bonuses are included because it is assumed that an extra dollar of pay will have the same effect on affiliation behavior no matter what the source of that dollar is. A problem arises because in addition to higher bonuses causing higher affiliation rates, lower affiliation rates may cause future bonuses to be higher. That is, the question of simultaneity bias must be addressed in estimating equation 1.

In [5] it is shown that including dummy variables for the NAVETs' ratings corrects for this simultaneity problem. In deciding which ratings qualify for bonuses, planners take into account manpower shortages, how costly it is to fill the shortages, and the criticality of the rating. One determinant of shortages is past affiliation rates. If past affiliation rates were low, then other things being equal, the rating is more likely to qualify for a bonus. The problem is that the estimated relationship between affiliation rates and pay will be biased downward if ratings with persistently low affiliation rates more often receive bonuses. This bias can be avoided, however, by letting rating dummy variables serve as proxies for past shortages in ratings. That is, among the other unobservable, rating-specific factors captured by the rating intercepts are past manning shortfalls in the rating.[7]

[7] This solution will not completely remove the simultaneity bias if the error terms in equation 1 are serially correlated. Reference [5] finds little evidence of autocorrelation, however, so no such correction is made here.

ESTIMATION METHOD

The version of equation 1 that is to be estimated, then, is:

$$\ln \frac{P_A}{(1-P_A)} = \beta_0 + \beta_1 WRES + \beta_2 URATE + \beta_3 PG + \beta_4 EDUC + \beta_5 MG + \beta_6 SEX + \beta_7 RACE + \beta_9 MARRIED + \beta_8 AGE + \beta_{10} REGIONS + \beta_{11} RATINGS + u \,. \quad (2)$$

Most of the variable names here were defined above or are self-explanatory. In addition, $URATE$ is the unemployment rate, PG is a matrix of dummy variables indicating the paygrade of the NAVET upon leaving active duty, MG is mental group, and $REGIONS$ and $RATINGS$ are matrices of regional and rating dummy variables. The exact definitions of the variables are given in the Data section that follows.

Maximum likelihood logit estimation is used, since when the veteran does not affiliate and P_A equals zero, the left-hand side of equation 2 is undefined. The estimation is done separately for each of the 11 rating groups. Observations that correspond to closed RAMOS categories are excluded.

DATA

The data set used in the estimation was constructed by finding active Navy losses on the Enlisted Master Records (EMRs) and matching them to SELRES affiliations on the Reserve Component Common Personnel Data System (RCCPDS). Appendix B contains details of the procedures used to construct the data set. Losses from April 1979 through September 1984 were taken from CNA's EMR files, which are described in [9]. Exclusions were made so that the sample contained only NAVETs who were lost after their first term and who left near the end of their obligated service. The veterans also had to be eligible to reenlist and reside in the United States. A total of 147,735 valid losses remained. Their distribution by calendar year is given in table 2. Notice that over 60 percent of the NAVETs in the sample were lost before the affiliation bonus program began in 1982. Of these valid losses, 2,174 eventually had to be deleted from the sample because of missing data items.

CLOSED RAMOS CATEGORIES

Of the remaining 145,561 losses, 49,752 were demand constrained and hence omitted prior to estimating equation 2, leaving 95,809 observations in the data set. Observations were deleted if upon leaving active duty the NAVET was in a rating and paygrade that fell in a closed RAMOS category (see appendix B for data sources). Some of these individuals do eventually join SELRES, and this method of interpreting demand constraints has the disadvantage of losing any information that is contained in the affiliation behavior of such individuals. Furthermore, if the behavior of NAVETs in initially closed rates is systematically different from the NAVETs included in the estimation, then the results reported below will be applicable only to veterans who face no demand constraints.

TABLE 2

LOSSES BY CALENDAR YEAR

Year	Number of NAVETs	Percent of losses
1979	25,884	17.5
1980	32,634	22.1
1981	31,299	21.2
1982	22,431	15.2
1983	18,593	12.6
1984	16,894	11.4
	147,735	100.0

In the sample used here, 17.6 percent of individuals initially in closed RAMOS categories join SELRES by 1985. On the other hand, 22.2 percent of those whose ratings are open when they leave active duty eventually affiliate. NAVETs whose rating and rate is closed when they leave active duty can join SELRES by obtaining special permission from COMNAVRESFOR, by changing ratings through direct conversion or in-service training, or by waiting until their rate and rating is open. The latter option does not seem to be used often, since in this sample the timing of accessions does not depend on whether one's rate is initially open or closed. For example, 45.1 percent of the NAVETs whose rates were initially closed and who eventually affiliated did so within three months of leaving active duty. The comparable figure for NAVETs whose rates were initially open is 46.7 percent. Furthermore, the percentage of total affiliations that occurred within a year of leaving active duty was 73.2 percent for those in initially closed rates and 73.8 percent for those in initially open rates.

Table 3 shows that there was wide variation in the number of closed ratings between the 11 rating groups. For example, in the administrative ratings, 63.6 percent of valid losses were in initially closed ratings, compared to only 3.3 percent in general detail ratings.

TABLE 3

NAVETS IN CLOSED RATES/RATINGS BY RATING GROUP

Rating group	Number of losses	Closed RAMOS	
		Number	Percent
1	9,390	351	3.7
2	19,094	5,791	30.3
3	16,614	2,836	17.1
4	10,194	1,038	10.1
5	1,742	799	45.9
6	12,277	7,804	63.6
7A	21,899	7,085	32.4
7S	32,241	18,071	56.0
8	10,984	3,122	28.4
9	6,144	2,689	43.8
10	4,982	166	3.3
	145,561	49,752	100.0

AFFILIATIONS WITH SELRES

The variable on the left-hand side of equation 2 is the log of the odds that a NAVET will join the Reserve. In the estimation, P_A is set equal to zero for a veteran who does not affiliate, and 1 for a veteran who does. To find NAVETs who join SELRES, the losses from the EMR are matched by Social Security Number to RCCPDS transactions from fiscal years 1979 to 1985. For estimation purposes, only gains that occurred between 6 months before and 12 months after the veteran's loss date are used. If this technique were not used, then losses that occurred early in the sample period would have more time to show up on the SELRES rosters, and thus would appear to be more likely to affiliate. Most affiliations do occur within the first year, and there is no reason to believe that the behavior of late joiners and early joiners differs systematically (see [8]). Table 4 shows that over all 11 rating groups, 16.4 percent of the eligible, first-term veterans in open ratings join SELRES within one year of leaving active duty. Table 5 breaks down the affiliation rates by rating groups, showing a range from 10.6 percent for electronic equipment repair ratings to 29.0 percent for medical ratings.

EXPLANATORY VARIABLES

In this section, the exact definitions of the variables on the right-hand side of equation 2, the determinants of affiliation behavior, will be discussed. All personal characteristics, paygrade, rating, and home of record are taken from the EMR. EMR rather than RCCPDS data are used because the data are believed to be more reliable. Furthermore, values of variables must be set when the veteran leaves active duty rather than when he affiliates in order to have consistent information for those who do and do not eventually join SELRES. Summary statistics describing the explanatory variables are given in table 4 for the 95,809 NAVETs that remained in the sample after excluding observations that were missing data or that

TABLE 4

DESCRIPTIVE STATISTICS FOR THE ENTIRE SAMPLE

Number of NAVETs	95,809
Number of ratings	75
Average real Reserve wages (1978 $)	1,136
Average unemployment rate (%)	7.7
Average age	23
Percent of NAVETs:	
Affiliating	16.4
Eligible for bonus	13.0
In paygrade E3	13.3
In paygrade E4	49.5
In paygrades E5 or E6	37.1
Female	7.6
Nonwhite	10.2
Not high school graduates	16.3
In lower mental groups	26.5
With home of record in:	
New England	5.9
Middle Atlantic	16.8
South Atlantic	13.8
East North Central	20.3
East South Central	5.2
West North Central	8.9
West South Central	9.2
Mountain	6.3
Pacific	13.7

TABLE 5

DESCRIPTIVE STATISTICS BY RATING GROUPS

	1	2	3	4	5	6	7A	7S	8	9	10
Number of NAVETs	9,039	13,303	13,778	9,156	943	4,473	14,814	14,170	7,862	3,455	4,816
Number of ratings	3	11	9	2	5	11	6	11	10	3	4
Percent of NAVETs:											
Affiliating	17.7	10.6	19.4	29.0	20.7	24.1	14.9	11.3	13.9	15.6	13.0
Eligible for bonus	24.4	6.8	19.5	26.2	12.9	27.7	2.7	5.0	15.5	17.4	0.0
Paygrade E3	10.0	5.2	7.5	10.3	3.6	10.1	6.7	10.4	9.3	20.2	100.0
Paygrades E5 or E6	33.3	60.9	46.5	24.5	40.8	31.4	31.2	38.9	44.5	11.1	0.0
Female	2.1	2.5	10.0	22.8	26.3	36.0	3.3	0.8	0.8	10.1	7.7
Nonwhite	10.4	5.3	12.0	13.7	5.6	18.1	12.3	5.9	4.7	11.6	19.2
Not HS graduates	25.6	9.3	12.4	7.8	6.9	12.6	18.1	20.1	17.2	20.9	29.9
Lower mental groups	41.9	6.9	19.4	13.5	5.8	30.9	37.3	27.5	29.5	35.4	48.4

were demand constrained. Greater detail is given in table 5 for variables that show interesting variation across rating groups.

Real Reserve Wages

Reserve wages are computed by summing annual pay for drills and affiliation bonuses. This total is then expressed in constant 1978 dollars. Annual drill pay is obtained from pay tables for Reserve forces, using the veteran's paygrade and length of service (LOS) upon leaving active duty. The maximum possible drill pay is used — that for one weekend per month and two weeks of ACDUTRA.

Bonus pay is assumed to be $300 per year for everyone who qualifies based on their rating and LOS. Ratings eligible for affiliation bonuses are taken from BUPERSINST 5400.42F. The program began in March 1982, and during the sample period the list of eligible ratings changed in January 1983, July 1983, and July 1984. (See [8] for lists of eligible ratings.) The LOS restriction is that the veteran must have left near the end of his obligated service, yet have some obligation remaining. In particular, a NAVET in an eligible rating can receive a bonus if he served between 48 and 66 months on active duty. Tables 4 and 5 report the percentage of veterans who were eligible for bonuses over all the years in the sample. These statistics mask considerable variation between years in the size of the bonus program. In the sample of 147,735 NAVETs, 81,432 left active duty in fiscal years 1979 to 1981, before the bonus program began. In fiscal year 1982, 16 percent of the 25,498 NAVETs could have qualified for a bonus. In fiscal years 1983 and 1984, 29 percent of 19,537 and 32 percent of 21,268 NAVETs, respectively, were eligible for bonuses.

Potential annual drill and bonus pay are added together for each veteran in the sample. The result is then expressed in constant 1978 dollars using the Consumer Price Index for all items reported in the Economic Report of the President, February 1986. The resulting real Reserve wages, the variable *WRES*, range from $850 to $1,585, with an average of $1,136.

Unemployment Rate

The unemployment rate used is that for all manufacturing workers in a particular state. Rates by state are given for each calendar year in the May issue of U. S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings. Unemployment rates are matched with observations on NAVETs by the calendar year in which the NAVET left active duty and his home of record in the EMR. This procedure introduces error to the extent that veterans affiliate later than their time of loss, or in a different state than their home of record. Also, unemployment rates specific to young males and to certain occupations would be preferable, but are not available by geographic location. The use of rating dummy variables, however, allows for variations in unemployment by occupation that are correlated with Navy ratings.

Paygrade

Almost half of the first-term NAVETs in the sample were in paygrade E4 when they left active duty. The remainder were in paygades E3 and E5, with less than 4 percent E6s. Paygrade was included in the estimation by entering one dummy variable that is set equal to 1 for E3s, and another dummy variable that is set equal to 1 for both E5s and E6s.

Education and Ability

Previous studies of active Navy survival and retention have shown that the most important aspect of education in predicting behavior is whether an individual graduated from a regular high school diploma program. Those who received equivalency certificates tend to behave like nongraduates. For this reason, the education variable, *NONGRAD*, was defined to distinguish high school diploma graduates. The variable is set equal to 1 if an individual did not graduate or if he or she received a high school degree by certificate. A value of zero is assigned to those with high school diplomas and those who completed some higher education.

The ability variable, *LOWERMG*, distinguishes upper and lower mental groups. The mental groups were not taken from the longitudinal EMRs but were calculated from the test scores on the full EMRs using a recently revised algorithm. *LOWERMG* equals 1 for those in MG3L and below, and equals zero for those in MG1, MG2, and MG3U.

Personal Characteristics

Personal characteristics influencing preferences and economic opportunities that are included are sex, race, marital status, and age. *FEMALE* equals 1 if the veteran is female, and zero otherwise. *NONWHITE* equals 1 if the veteran's race reported on the EMR was anything other than white. *MARRIED* equals 1 for all veterans who were married when they left active duty. Similarly, *AGE* reports age upon separation.

Census Regions

Geographic region is indicated by the census region of the veteran's home of record. Definitions of census regions are given in table 6. Broad geographic regions are used to increase the precision of the coefficient estimates, and because it is not believed that affiliation rates vary over narrow geographic areas. Furthermore, the home of record is such a poor measure of where the veteran will eventually locate, that more specific geographical divisions would not have much meaning. First-term Navy losses are young men and women who tend to be quite mobile. Often the home of record on the EMR is their home before they entered the Navy and not necessarily where they will reside when they actually consider joining SELRES.

To illustrate the mobility of the NAVETs, one can examine whether those who eventually do join SELRES do so in the state or census region given by their EMR home of record. This is done by comparing the address given in the EMR with the address given in RCCPDS. Of the

TABLE 6

CENSUS REGIONS

Label	Census region	States
NE	New England	ME, NH, VT, MA, RI, CT
MA	Middle Atlantic	NY, NJ, PA
SA	South Atlantic	DE, MD, DC, VA, WV, NC, SC, GA, FL
ENC	East North Central	MI, OH, IN, WI, IL
ESC	East South Central	KY, TN, AL, MS
WNC	West North Central	MN, IA, MO, ND, SD, NE, KS
WSC	West South Central	AR, LA, OK, TX
MO	Mountain	MT, WY, CO, NM, ID, UT, AZ, NV
PA	Pacific	WA, OR, CA, AK, HI

30,526 NAVETs in the sample who eventually join SELRES, 9,871, or over 32 percent, join in a state other than their home of record. They do not even tend to stay in the same census region, as 8,103, or 26.5 percent change census regions.

Ratings

The estimation is done separately for each of the rating groups defined in table 1. Within each rating group, dummy variables are included to distinguish between veterans in different ratings. The variable for the largest rating in each group is omitted, where the largest rating is indicated by an asterisk in table 1.

RESULTS

The complete results of estimating equation 2 are given in appendix tables C-1 and C-2. The fit of the model was good, with tests of the overall significance of the regression supported at the 1-percent confidence level for all 11 rating groups. The coefficients reported in the appendix tables indicate what effect a change in the variable would have on the log of the odds of a NAVET affiliating. It is useful to convert these coefficients to direct estimates of how the probability of affiliating changes as the explanatory variables change. In the sections below, these estimates are presented, along with a discussion of which explanatory variables were significant determinants of accession behavior.

PAY AND UNEMPLOYMENT EFFECTS

As mentioned earlier, there has been considerable debate regarding the sensitivity of Reservists to pay. The results of this study indicate that pay has a significant and positive influence on affiliation rates in 6 out of the 11 rating groups, including 5 of the 7 largest groups. Furthermore, higher unemployment rates cause affiliation rates to increase significantly in 10 out of the 11 rating groups. Two measures of the responsiveness of affiliation rates to changes in pay are presented. The first measure discussed is the pay elasticity, which gives the percentage change in affiliation rates that is caused by a 1-percent change in real Reserve wages. Estimated elasticities of affiliation rates with respect to civilian unemployment rates are also presented. The second way of measuring responsiveness to pay is to calculate estimated affiliation rates both with and without an affiliation bonus program in effect. This comparison is made in the second section that follows.

Elasticities

Pay and unemployment rate elasticities and their significance levels are given in table 7.[8] The range of the significant pay elasticities is from 0.77 for construction ratings to 1.95 for administrative and clerical ratings. The elasticity of 1.29 for the medical ratings implies, for example, that affiliation rates will increase by 1.29 percent per every 1-percent increase in real Reserve pay. To illustrate, average real Reserve pay for group 4 in the estimation sample was $1,154. A 10-percent pay increase would raise average pay to $1,269. Then with an elasticity of 1.29, the affiliation rate would increase by 12.9 percent, or from 29.0 to 32.7 (the initial affiliation rate is taken from table 5). Such a pay increase would be predicted to increase SELRES affiliations by 3.7 people per every 100 people leaving active duty after their first term. These elasticities are similar to those found in studies of active Navy retention [2 and 4], and also in a previous study of NAVET accessions [3].

The insignificant pay elasticities occur in rating groups with few observations (other technical, service/supply, and general detail) or that have few persons eligible for bonuses (mechanical equipment repair). The latter condition would limit the sources of variation in pay to variation over time or over paygrades. With less independent variation in pay, the pay elasticity will be estimated less precisely. There is reason to believe, then, that the lack of positive, significant results in all cases is a result of estimation problems rather than an indication of little sensitivity to pay. These results support the hypothesis that young, enlisted Reservists respond to pay in much the same way as do regular Navy enlistees. The same conclusion, however, might not hold for enlisted members with longer terms of service, or for officers.

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[8] For the logistic model given by equation 2, the estimated elasticity of P_A with respect to variable X is given by $\beta X(1 - P_A)$. Here β is the estimated coefficient of X, and X and P_A are evaluated at their sample means. The elasticity is significant if the coefficient β is significant, as reported in appendix table C-1.

TABLE 7

PAY AND UNEMPLOYMENT RATE ELASTICITIES

Group	Pay	Unemployment rate
1	1.47**	0.35**
2	1.01**	0.37**
3	0.98**	0.34**
4	1.29**	0.51**
5	0.70	0.33
6	1.95**	0.63**
7A	-0.56	0.31**
7S	0.44	0.63**
8	0.77*	0.63**
9	0.16	0.54**
10	0.25	0.90**

Note: Two asterisks indicate significance at the 1-percent confidence level, and one asterisk, at the 5-percent level.

The elasticity with respect to the unemployment rate gives the estimated percentage increase in the affiliation rate given a 1-percent increase in the unemployment rate. Table 7 shows that these elasticities are positive and statistically significant in 10 of the 11 rating groups and range from 0.31 to 0.90. An average of the significant elasticities, weighted by the number of observations per group, is 0.47. These results indicate that Reserve membership is more attractive in periods of high unemployment. For example, the unemployment rate elasticity for rating group four, the medical ratings, equals 0.51. Suppose that the unemployment rate in 1985 had increased from 7.2 percent to 7.9 percent, a 10-percent increase. The estimated affiliation rate for a typical NAVET in group four would increase by 5.1 percent, or assuming no bonus is paid, from 0.22 to 0.23. In other words, this increase in the unemployment rate would result in 1 extra SELRES hospital corpsman for every 100 typical eligible veterans.

Estimated Affiliation Rates

Another way to measure pay sensitivity is to calculate what effect the bonus has on estimated affiliation rates. In table 8, these calculations are performed for a notional NAVET. The notional NAVET has the characteristics most common in the sample, as detailed in the note to table 8. Furthermore, drill pay and unemployment rates are set at average 1985 levels. The estimated affiliation rates assuming no bonus is paid are presented for all rating groups. Also, the estimates assuming a yearly $300 affiliation bonus are presented for the rating groups that have significant pay elasticities. The results for rating group 4 show, for example, that the expected affiliation rate for typical first-term hospital corpsmen would be 22 per 100 NAVETs without a bonus. This rate would increase to 27 per 100 with the bonus. Taking a weighted average over the groups with significant results reveals that the bonus produces almost 3 extra SELRES accessions within the first year of loss for every 100 eligible first-term veterans with the most common characteristics.

TABLE 8

ESTIMATED AFFILIATION RATES FOR NOTIONAL NAVETS

Rating group	Affiliation rates	
	Without bonus	With bonus
1	0.13	0.17
2	0.08	0.09
3	0.14	0.17
4	0.22	0.27
5	0.11	—
6	0.11	0.16
7A	0.10	—
7S	0.06	—
8	0.10	0.11
9	0.12	—
10	0.10	—

Note: Notional NAVETs are in paygrade E4, high school graduates, upper mental group, male, white, age 23, residents of the East North Central census region, and in the following ratings: 1. BM, 2. ET, 3. RM, 4. HM, 5. AG, 6. YN, 7A. AM, 7S. MM, 8. HT, 9. MS, 10. SN. The unemployment rate is set at 7.2 percent, the rate for all civilian workers in 1985. Total yearly drill pay for paygrade E4 with between four and six years of service was $1,910.54 in 1985, or $1,159 in 1978 dollars. With a nominal bonus of $300, total yearly earnings become $1,341 in 1978 dollars.

GEOGRAPHIC EFFECTS

Table 9 shows the estimated effects of census regions on affiliation rates. The figures given are the estimated changes in the probability of affiliation if an average NAVET in the rating group lived in the indicated census region rather than in the East North Central region. With categorical variables such as census regions, it does not make sense to calculate elasticities, since there cannot be a 1-percent change in region. Instead, the relevant measure is the change in the probability of affiliation relative to the base case.[9]

Altogether, 88 regional shift coefficients are estimated, for the 8 regions in each of 11 rating groups. Of these, there are no significant, negative regional effects, indicating that affiliation rates are nowhere lower than in the East North Central region. There are a total of 40 significant, positive effects: 8 each for New England and West North Central, 7 for South Atlantic, 6 each for West South Central and Mountain, 4 for Middle Atlantic, 1 for Pacific, and none for East South Central. Thus, there is little support for regional differences in affiliation rates between the East North Central, East South Central, and Pacific regions. There is, however, moderate support for higher affiliation rates in the Middle Atlantic region, and strong support for higher rates in the other five regions. In these five regions, the significant results indicate that regional differences in affiliation rates range from 0.028 to 0.12. These shifts can be compared to the estimated affiliation rates for typical East North Central residents given in table 8. For example, with bonuses, 27 out of 100 hospital corpsmen who are East North Central residents are expected to join SELRES. For residents of New England, this number increases by 7.1 to over 34 out of 100, an increase of over 25 percent.

[9]The estimated change in P_A as categorical variable X changes from 0 to 1 is given by $\beta P_A(1-P_A)$. Here β is the estimated coefficient of X, and P_A is the observed affiliation rate in the sample. This partial effect of X is significant if the estimate of β is significant.

TABLE 9

PARTIAL EFFECTS ON P_A OF CATEGORICAL VARIABLES

	1	2	3	4	5	6	7A	7S	8	9	10
E3	0.0042	-0.036*	-0.0010	-0.13**	-0.19	0.0014	-0.046**	-0.0052	-0.042*	-0.043*	—
E5/6	0.011	-0.015*	0.032**	0.058**	0.038	0.038*	0.041**	-0.012	0.015	0.028	—
FEMALE	0.079**	0.083**	0.042**	0.068**	0.12**	0.12**	0.10**	0.077**	0.15**	0.037	0.013
NONWHITE	0.13**	0.085**	0.15**	0.11**	0.013	0.12**	0.12**	0.076**	0.11**	0.10**	0.11**
NE	0.047*	0.042**	0.033	0.071**	0.087	0.12**	0.062**	0.072**	0.037*	0.071*	0.028
MA	0.027	0.011	0.019	0.062**	-0.0061	0.090**	0.019	0.043**	0.040**	0.0019	0.018
SA	0.031*	0.015	0.035**	0.068**	0.048	0.058*	0.013	0.045**	0.030	0.077**	0.051**
ESC	-0.0050	-0.018	-0.0020	0.041	0.11	0.032	-0.0067	0.0037	0.026	0.039	-0.018
WNC	0.040*	0.028*	0.062**	0.080**	0.092	0.086**	0.024	0.067**	0.053**	0.075**	0.027
WSC	0.046**	0.016	0.056**	0.080**	0.063	0.089**	0.0042	0.043**	0.049*	0.043	0.015
MO	0.053**	0.0085	0.049**	0.072**	0.075	0.072*	-0.018	0.036**	0.059**	0.037	0.035
PA	-0.012	-0.0029	-0.0084	0.035	0.069	0.046	-0.010	0.026*	0.015	-0.040	-0.0047

Note: One asterisk indicates significance at the 5-percent confidence level, and two asterisks, at the 1-percent level.

The differences in affiliation behavior between regions could be caused by differences between regions in preferences, in civilian job opportunities, or in income levels. Since unemployment rates by state are included, however, the differences in economic opportunity must be other than those reflected in unemployment rates for all civilian workers. It could be, for example, that young men have different access to part-time employment in states that have similar overall unemployment rates. Also, wages for similar jobs may vary between regions.

Although the results show regional shifts in the estimated affiliation rates, there is little evidence of differences in pay elasticities between regions. A statistical test of the hypothesis that pay elasticities differ between the nine census regions is rejected in 10 of the 11 rating groups. Appendix C gives the details of this test and table C-3 reports the results. The conclusion is that affiliation rates differ between regions because of unobserved variations in tastes and opportunities, not because of regional variations in sensitivity to pay. As a result, better estimates of pay effects can be obtained if observations from different regions are combined.

OTHER DETERMINANTS

Personal Characteristics

Of the other affiliation determinants included in the model, the estimated effects of race and sex are among the strongest. Both nonwhite and female NAVETs have significantly higher estimated affiliation probabilities. As table 9 shows, the average female NAVET's affiliation rate is significantly higher than the average male's in 9 of the 11 rating groups. The estimated increase in the significant cases ranges from 0.042 to 0.15. Such increases can as much as double the estimated rates for typical male NAVETs reported in table 8. The differentials for nonwhites are even larger. The partial effects for nonwhites are significant in 10 of 11 rating

groups and range from 0.076 to 0.15. The implication is that if the mix of people leaving active duty changes so that females and nonwhites are more highly represented, affiliations with SELRES can be expected to rise. Furthermore, observed differences in affiliation rates between ratings may be caused by differences in racial and sex compositions.

As discussed earlier in the Empirical Model section, personal characteristics may affect accession behavior because of differences in tastes for Reserve service, in opportunities for civilian employment, or in incomes. It is possible that white males have the best access to part-time civilian jobs and that nonwhites and women are more apt to join SELRES because they cannot find civilian jobs. Another possibility is that nonwhites and women are less likely to have full-time civilian jobs and thus may rely on Reserve pay as their only source of income.

The other personal characteristics included in the model are age and marital status. The results for these variables are included in appendix table C-1, but not in table 9 because they are rarely significant. Age has a significant, positive relationship with affiliation rates in only 1 of the 11 rating groups. Being married significantly decreases the probability of affiliation in 3 of 11 cases.

Education and Ability

The only measure of ability that was significant in many rating groups was paygrade. As shown in table 9, persons who were in paygrade E3 upon leaving active duty are significantly less likely to join SELRES in 5 of 11 rating groups. The range of the significant partial effects is from -0.036 to -0.13. On the other hand, advancing beyond E4 by the end of the first term significantly increases affiliation rates in four cases. There is one significant, negative sign. The partial effects range from -0.015 to 0.058. These results suggest that more rapid advancement in the active Navy increases the chances of SELRES membership. A possible interpretation

is that those who advance more rapidly want to continue their association with the Navy and at the same time pursue lucrative civilian careers. It is also possible that they anticipate higher future SELRES earnings. The effect of present SELRES earnings is captured by the pay variable, but paygrade may serve as an indicator of the ability to earn future promotions in the Reserve.

Results for high school graduation status and mental group are seldom significant and thus are reported in appendix C. Non-high-school graduates were significantly less likely to affiliate in two rating groups and significantly more likely in one group. Those in lower mental groups were significantly more likely to affiliate in two cases.

Ratings

Observed affiliation rates may differ between rating groups and ratings in part because of differences in the economic opportunities, personal characteristics, paygrade mix, and regional distribution of the NAVETs in the ratings. The estimated affiliation rates in table 8 are calculated holding many of these factors fixed, so that variations caused by unmeasured differences between rating groups can be isolated. The results show some remaining variation in affiliation rates, although less than is exhibited by the observed sample affiliation rates presented in table 5. The results in tables 7 and 9 also seem to indicate that the coefficients in equation 2 vary between rating groups.[10]

Categorical variables for Navy rating are included in the estimation within each rating group. The estimated coefficients for the rating dummy variables are presented in appendix table C-2. The results show significant differences in affiliation rates between individual ratings within groups in 21 out of 64 cases.

[10]It was not possible to perform statistical tests of whether affiliation rates and coefficients vary between rating groups because a model including all observations and all rating dummies is too large to estimate using maximum likelihood logit techniques.

CONCLUSIONS

The major findings and recommendations of this study are:

- Compensation is an important determinant of how many Navy veterans affiliate with SELRES. The results of this study suggest that Reservists respond to changes in compensation in ways that are similar to their active duty counterparts. The use of such policy tools as affiliation bonuses and unit incentive pay is therefore supported. Pay elasticities that will allow the effects of these policies to be predicted are presented. Although no study was made of Training and Administration of Reserves (TARs), if TARs respond to pay in the same way that both Reservists and persons on active duty have been shown to, then by analogy paying Selective Reenlistment Bonuses to TARs will increase their accession and retention rates.

- Economic conditions such as high inflation rates or low unemployment rates make the SELRES recruiting environment more difficult. Measures of the responsiveness of SELRES accessions to changes in unemployment rates are presented.

- Affiliation rates differ between some geographical areas, but these differences are not caused by variations in the responsiveness to pay. Thus, the effects of changes in pay can be estimated at a national level. Regional shifts in affiliation rates can then be taken into account.

- Female and nonwhite veterans are significantly more likely to join SELRES. In some cases, the estimated affiliation rates for women and nonwhites are twice as high as the rates for typical white male NAVETs.

- More rapid advancement during active duty is estimated to increase the likelihood of SELRES membership.

- Since there are significant differences in accession behavior, predictions of affiliation rates should take into account changes in the regional, rating, sex, and racial composition of the pool of eligible NAVETs. The results in this paper should therefore be of use in models that forecast SELRES strength attainability by rating and geographical area.

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APPENDIX A

MATHEMATICAL MODEL OF NAVET AFFILIATION WITH THE SELECTED RESERVE

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MATHEMATICAL MODEL OF NAVET AFFILIATION WITH THE SELECTED RESERVE

Upon leaving active duty, a veteran chooses whether or not to enlist in the Selected Reserve. It is assumed that the veteran chooses the option that results in the greatest utility. Utility is expressed in dollar terms as the sum of annual income and the monetary equivalent of a year's stream of nonpecuniary job characteristics. These indirect utility functions can be expressed as:

$$V_R = W_R + \delta_R$$
$$V_C = W_C + \delta_C.$$

Here the subscripts R and C denote those joining the Reserve and remaining civilians, respectively. Also, V is utility expressed in dollars, W is total annual wages, and δ is the annualized value of nonmonetary aspects of employment.

Certain assumptions must be made about utility functions in order to express utility in this manner. In particular, the marginal utility of income must be assumed to be independent of both income and leisure. Furthermore, the problem of calculating the present value of future income streams associated with each course of action is ignored here. First, since the NAVET's association with SELRES is voluntary, he can reevaluate his decision at least once a year. Also, although affiliation bonus payments may be spread out over more than one year, or more than one year's payment may be made in a lump sum, the amounts involved and the time horizon are small.

Notice that

$$W_R = WFT + WRES$$
$$W_C = WFT + WPT.$$

In other words, a Reservist's total annual income equals his income from his full-time civilian job (WFT) plus his Reserve compensation ($WRES$). A civilian's total annual income equals his income from his full-time civilian job and from his part-time civilian job, if any (WPT). If a person holds the same full-time job regardless of SELRES membership, then WFT affects V_R and V_C equally. This result depends on the assumption that the utility received from an extra dollar of income does not depend on the level of income being earned or on the amount of leisure being taken.

The values of nonpecuniary job characteristics can be expressed as follows:

$$\delta_R = \alpha_R^0 + \alpha_R^1 Z + \alpha_R^2 JCFT + \alpha_R^3 JCRES + \gamma_R$$
$$\delta_C = \alpha_C^0 + \alpha_C^1 Z + \alpha_C^2 JCFT + \alpha_C^3 JCPT + \gamma_C ,$$

where

Z = a vector of personal characteristics that condition tastes
$JCFT$ = a vector of civilian full-time job characteristics
$JCRES$ = a vector of Reserve job characteristics
$JCPT$ = a vector of civilian part-time job characteristics
γ = remaining random influences.

Further, the αs are vectors of coefficients that transform personal characteristics and job characteristics into dollar equivalents of utility. The intercept terms imply that being in the Reserve or not has a systematic effect on utility apart from the effects captured by the attributes.

The probability of affiliating, P_A, equals one if $V_R > V_C$, or if

$$\begin{aligned}\gamma_C - \gamma_R \;<\; & (WRES - WPT) + (\alpha_R^0 - \alpha_C^0) + (\alpha_R^1 - \alpha_C^1)Z + \\ & (\alpha_R^2 - \alpha_C^2)JCFT + \alpha_R^3 JCRES - \alpha_C^3 JCPT\,.\end{aligned}$$

If $\gamma_C - \gamma_R$ is assumed to have a logistic cumulative distribution function, the following specification of the probability of affiliating is implied:

$$\begin{aligned}\ln \frac{P_A}{(1 - P_A)} \;=\; & \beta_0 + \beta_1(WRES - WPT) + \beta_2 Z + \beta_3 JCFT + \\ & \beta_4 JCRES + \beta_5 JCPT + u\,.\end{aligned}$$

The βs in this equation are transformations of the αs above.

APPENDIX B

CONSTRUCTION OF THE DATA SAMPLE

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CONSTRUCTION OF THE DATA SAMPLE

Losses with a STRENGTH-LOSS-DATE in fiscal years 1979 to 1985 were identified on the Enlisted Master Records (EMRs) based on their strength code indicator (SCIND). A total of 591,999 losses were identified, and of these, 444,264 were excluded because the Reservists were not first-term, eligible to reenlist, living in the United States, regular Navy, or were not lost near their end of service. The exclusions were made in the order given, so that to be excluded for having the wrong enlistment type, for example, the paygrade must have been E3 through E6. Persons were excluded from the sample for these reasons:

- Their length of service was over 78 months. Length of service is the difference between the STRENGTH-LOSS-DATE and the active duty service date (ADSD). This excludes some of those who are not first-termers. Records excluded: 109,308.
- They were Active Mariners (AMs). Since AMs are obligated to join SELRES, their behavior differs from that of NAVETs. AMs are identified by BRANCH-CLASS of 32, special program code (SPC) beginning with AZ, or AMZ99, and an ENL-NUMBER of 1. Records excluded: 83,280.
- They had a special program indicator (SPI) for TAR/TEMAC of U, W, X, Y, or Z. This eliminates those on temporary active duty. Records excluded: 401.
- They had a reenlistment quality code (RQC) not equal to 1, 1R, 3B, 3R, R1, or blank. According to BUPERSINST 5400.42F, Chapter II, paragraph 203, only persons with these reenlistment codes are eligible to join SELRES without obtaining waivers. Records excluded: 180,541.

- Their loss date was not between April 1979 and September 1984. This restriction was necessary to create one-year affiliation measures with affiliations for fiscal years 1979 to 1985. Records excluded: 39,779.
- Their PAYGRADE was not equal to E3 through E6. Persons with paygrades E1 and E2 are not eligible to join SELRES, and those in paygrades above E6 cannot be in their first enlistment. Records excluded: 11,270.
- They had an ENL-TYPE equal to 20 – 51 and 94 – 95. This excludes those who have reenlisted or been recalled to active duty. Records excluded: 5,728.
- Their RQC was blank. It could not be determined whether these persons were eligible to join SELRES. Records excluded: 3,893.
- They had an ENL-NUMBER other than 1. For these records, ENL-TYPE may have been in error. Records excluded: 60.
- Their HOME-OF-RECORD was not in the United States. The state must be in one of the nine census regions. Records excluded: 2,004.
- Their BRANCH-CLASS was other than 11. This excludes Training and Administration of Reserves (TARs) and retired recalls. Records excluded: 124.
- They had a RATE-CODE of MA, NC, LN, or AS. These ratings are restricted to second-term enlistments. Records excluded: 54.
- They had an SPI for TAR/TEMAC of V. This and a BRANCH-CLASS of 11 are inconsistent. Records excluded: 7.
- They were older than 39 at time of loss. Records excluded: 6.
- Their SOFT-EAOS was not within one year of the loss date. According to BUPERSINST 5400.42F, Chapter VI, paragraph 201, one must have completed the term of active obligated service to be eligible for an affiliation bonus. Records excluded: 7,788.

After these exclusions, 147,735 losses remained, of which 2,174 were excluded because of missing data in a variable required for estimation.

RAMOS category was taken from the following sources, where sources are listed only when there is some change in the categories. In these instructions, RAMOS categories are X for closed and O for open: BUPERSINST 5400.42D, Change 12, May 1978; .42E, March 1979; Change 1, December 1979; Change 2, April 1980; Change 3, October 1980; Change 4, August 1981. In these instructions, RAMOS categories A, B, and C are open, and D and E are closed: CNAVRESNOTE 1123, November 1981; Change 3, March 1982; Change 4, July 1982; CNAVRESINST 1123.1, October 1982; Change 1, January 1983; Change 4, April 1983; Change 6, August 1983; 1123.1A, November 1983; Change 1, January 1984; Change 2, April 1984.

An affiliation with SELRES is assumed to occur if a gain transaction to the Selected Reserve for the Social Security Number (SSN) appears in the Reserve Component Common Personnel Data System's (RCCPDS) transaction files. One-year affiliation flags are assigned a value of 1 if the effective date for the gain is within −6 to +12 months of the loss date on the EMR. There is some difficulty with the affiliation measure because of the quality of data in the RCCPDS. In particular, 2,593 of the 147,735 valid EMR losses had transactions on the RCCPDS that indicated a gain and loss occurred simultaneously on the same day. Of these, all but 1,365 had another valid gain date that could be used. The remaining 1,365 that appeared to be gained and lost to SELRES on the same day were not counted as affiliations. If these people really were SELRES members, then the total number of affiliations (within the sample period, not within one year) would increase from 30,256 to 31,891. In other words, up to 4.3 percent of the gains may have been excluded by ignoring simultaneous gains and losses. This would change the overall affiliation rate to $31,891/147,735 = 0.216$ from $30,256/147,735 = 0.207$.

APPENDIX C

RESULTS OF MAXIMUM LIKELIHOOD LOGIT ESTIMATION

APPENDIX C

RESULTS OF MAXIMUM LIKELIHOOD LOGIT ESTIMATION

Tables C-1 and C-2 give the results of the the maximum likelihood logit estimation of equation 2. In both tables, the numbers in parentheses are standard errors. Table C-1 gives results for variables that were common to all rating groups. Table C-2 gives results for the rating dummy variables within the rating groups. Tests of whether individual coefficients are significantly different from zero are conducted by assuming that the parameter estimate divided by its standard error has an asymptotic normal distribution. The critical values for such a two-tailed test are 1.96 for a 95-percent confidence region and 2.58 for a 99-percent confidence region. In the tables, one asterisk indicates significance at a 5-percent confidence level, and two asterisks indicate significance at a 1-percent confidence level.

Joint hypotheses tests on the coefficients can be performed using a likelihood ratio test. The test is defined by:

$$LRT = 2[\ell(\hat{\beta}_{ML}) - \ell(\hat{\beta}_{CML})] .$$

Here ℓ is the log-likelihood function, $\hat{\beta}_{ML}$ is the unconstrained maximum likelihood estimator, and $\hat{\beta}_{CML}$ is the constrained maximum likelihood estimator. The test statistic is asymptotically distributed as χ^2_q, where q is the number of restrictions. To test for the significance of all independent variables, all βs except β_0 are constrained to be zero. The degrees of freedom are equal to the number of independent variables. The results of this test are given in Table C-1, which shows that all of the regessions are highly significant.

Table C-2 also shows the percentage of observations in a rating group that fell within certain ratings. This is the percentage of observations in

the sample used for estimation after closed RAMOS observations were excluded. The percentages thus correspond to the total numbers of NAVETs in each rating group given in table 5.

TABLE C-1

MAXIMUM LIKELIHOOD LOGIT COEFFICIENT ESTIMATES

Group	1	2	3	4	5	6
CONSTANT	-3.71	-3.39	-3.54	-3.39	-4.09	-5.82
	(0.45)**	(0.47)**	(0.33)**	(0.32)**	(1.25)**	(0.56)**
WRES	0.0015	0.0010	0.0011	0.0016	0.0008	0.0022
	(0.0002)**	(0.0003)**	(0.0002)**	(0.0002)**	(0.0009)	(0.0004)**
URATE	0.056	0.052	0.057	0.094	0.053	0.10
	(0.016)**	(0.016)**	(0.013)**	(0.014)**	(0.051)	(0.018)**
E3	0.029	-0.38	-0.0064	-0.61	-1.15	0.0078
	(0.10)	(0.16)*	(0.092)	(0.094)**	(0.65)	(0.14)
E5/6	0.074	-0.16	0.21	0.28	0.23	0.21
	(0.066)	(0.069)*	(0.051)**	(0.057)**	(0.18)	(0.087)*
NONGRAD	0.0016	-0.10	0.052	0.0047	0.73	0.12
	(0.068)	(0.10)	(0.070)	(0.090)	(0.30)*	(0.11)
LOWERMG	0.020	0.11	-0.023	0.021	0.54	0.024
	(0.061)	(0.11)	(0.060)	(0.071)	(0.33)	(0.085)
FEMALE	0.54	0.87	0.27	0.43	0.74	0.66
	(0.17)**	(0.14)**	(0.072)**	(0.055)**	(0.19)**	(0.083)**
NONWHITE	0.92	0.89	0.94	0.53	0.077	0.67
	(0.081)**	(0.10)**	(0.063)**	(0.068)**	(0.35)	(0.094)**
MARRIED	0.055	-0.11	-0.11	-0.26	-0.15	-0.26
	(0.061)	(0.063)	(0.049)*	(0.049)**	(0.18)	(0.079)**
AGE	-0.017	-0.025	0.0055	-0.016	0.029	0.023
	(0.016)	(0.015)	(0.011)	(0.0100)	(0.035)	(0.015)
NE	0.32	0.44	0.21	0.35	0.53	0.63
	(0.14)*	(0.14)**	(0.12)	(0.13)**	(0.40)	(0.19)**
MA	0.18	0.12	0.12	0.30	-0.037	0.49
	(0.098)	(0.099)	(0.079)	(0.083)**	(0.32)	(0.13)**
SA	0.21	0.15	0.22	0.33	0.29	0.32
	(0.11)*	(0.11)	(0.084)**	(0.093)**	(0.33)	(0.14)*
ESC	-0.034	-0.19	-0.013	0.20	0.70	0.18
	(0.14)	(0.15)	(0.10)	(0.12)	(0.44)	(0.16)
WNC	0.27	0.29	0.39	0.39	0.56	0.47
	(0.13)*	(0.13)*	(0.10)**	(0.12)**	(0.38)	(0.17)**
WSC	0.32	0.17	0.36	0.39	0.39	0.49
	(0.12)**	(0.13)	(0.095)**	(0.11)**	(0.40)	(0.16)**
MO	0.36	0.089	0.31	0.35	0.46	0.40
	(0.13)**	(0.14)	(0.11)**	(0.12)**	(0.42)	(0.20)*
PA	-0.085	-0.031	-0.054	0.17	0.42	0.25
	(0.11)	(0.11)	(0.088)	(0.087)	(0.31)	(0.14)
χ^2	253.69**	372.36**	532.15**	416.89**	49.13**	311.27**
q	20	28	26	19	22	28

TABLE C-1 (Continued)

Group	7A	7S	8	9	10
CONSTANT	-2.54	-3.57	-4.04	-3.36	-3.44
	(0.45)**	(0.47)**	(0.53)**	(0.76)**	(1.08)**
WRES	-0.0006	0.0004	0.0008	0.0002	0.0003
	(0.0003)	(0.0003)	(0.0003)*	(0.0005)	(0.0010)
URATE	0.050	0.092	0.094	0.084	0.14
	(0.013)**	(0.015)**	(0.018)**	(0.028)**	(0.024)**
E3	-0.36	-0.052	-0.35	-0.33	—
	(0.11)**	(0.100)	(0.14)*	(0.15)*	—
E5/6	0.32	-0.12	0.12	0.21	—
	(0.056)**	(0.067)	(0.073)	(0.16)	—
NONGRAD	-0.16	-0.076	-0.038	-0.32	-0.16
	(0.067)*	(0.072)	(0.091)	(0.13)*	(0.10)
LOWERMG	0.14	0.15	-0.024	0.10	0.064
	(0.051)**	(0.062)*	(0.075)	(0.10)	(0.093)
FEMALE	0.80	0.77	1.25	0.28	0.11
	(0.11)**	(0.22)**	(0.27)**	(0.15)	(0.16)
NONWHITE	0.91	0.76	0.92	0.76	1.01
	(0.064)**	(0.094)**	(0.13)**	(0.14)**	(0.10)**
MARRIED	-0.062	-0.062	-0.018	-0.072	-0.079
	(0.051)	(0.059)	(0.071)	(0.11)	(0.10)
AGE	0.031	-0.016	0.011	0.024	-0.0022
	(0.013)*	(0.016)	(0.019)	(0.024)	(0.022)
NE	0.49	0.72	0.31	0.54	0.25
	(0.11)**	(0.14)**	(0.16)*	(0.22)*	(0.26)
MA	0.15	0.43	0.33	0.015	0.16
	(0.082)	(0.094)**	(0.11)**	(0.16)	(0.15)
SA	0.10	0.45	0.25	0.58	0.45
	(0.087)	(0.11)**	(0.14)	(0.19)**	(0.16)**
ESC	-0.053	0.037	0.22	0.30	-0.16
	(0.11)	(0.15)	(0.18)	(0.25)	(0.21)
WNC	0.19	0.67	0.45	0.57	0.24
	(0.11)	(0.12)**	(0.15)**	(0.22)**	(0.22)
WSC	0.033	0.43	0.41	0.32	0.13
	(0.10)	(0.13)**	(0.16)*	(0.24)	(0.19)
MO	-0.14	0.36	0.49	0.28	0.31
	(0.12)	(0.13)**	(0.16)**	(0.26)	(0.23)
PA	-0.080	0.26	0.13	-0.30	-0.042
	(0.088)	(0.10)*	(0.12)	(0.20)	(0.16)
χ^2	453.09**	309.95**	147.81**	100.39**	189.75**
q	23	28	27	20	19

TABLE C-2

RATING COMPOSITION AND ESTIMATES OF RATING COEFFICIENTS

Rating group 1

	Percent in rating	Coefficient estimates
GMG	22.8	-0.026 (0.073)
QM	19.6	-0.011 (0.078)
BM	57.6	—

Rating group 2

	Percent in rating	Coefficient estimates
AQ	3.6	-0.086 (0.18)
AT	20.4	0.48 (0.088)**
AX	4.1	0.59 (0.14)**
CTM	2.8	0.16 (0.19)
DS	3.6	-0.61 (0.23)**
FT	19.5	0.12 (0.096)
MT	0.4	-7.81 (22.65)
ST	10.4	0.16 (0.12)
TD	0.7	-0.26 (0.43)
TM	9.3	0.94 (0.11)**
ET	25.3	—

Rating group 3

	Percent in rating	Coefficient estimates
AC	5.0	-0.19 (0.11)
AW	5.8	0.49 (0.093)**
CT	11.4	0.15 (0.073)*
EW	4.8	-0.76 (0.14)**
IS	1.9	0.39 (0.15)**
OS	23.4	-0.33 (0.066)**
OT	2.4	0.015 (0.15)
SM	9.0	-0.13 (0.086)
RM	36.3	—

Rating group 4

	Percent in rating	Coefficient estimates
DT	7.4	-0.16 (0.092)
HM	92.6	—

TABLE C-2 (Continued)

Rating group5

	Percent in rating	Coefficient estimates
DM	5.5	-0.027 (0.36)
EA	5.2	0.96 (0.37)**
MU	1.1	-9.87 (84.67)
PH	26.2	0.26 (0.21)
AG	62.0	—

Rating group 6

	Percent in rating	Coefficient estimates
AK	10.6	-0.063 (0.13)
AZ	6.5	-0.29 (0.19)
CTA	2.4	0.079 (0.25)
DK	0.2	0.096 (0.82)
DP	7.7	-0.19 (0.15)
JO	0.7	0.23 (0.40)
PC	0.4	0.18 (0.66)
PN	3.3	0.060 (0.22)
RP	1.6	0.30 (0.27)
SK	27.6	0.0044 (0.097)
YN	39.0	—

Rating group 7A

	Percent in rating	Coefficient estimates
AB	5.2	-0.43 (0.13)**
AD	25.5	0.10 (0.060)
AE	10.4	-0.11 (0.088)
AO	15.6	0.25 (0.068)**
AS	5.1	0.0076 (0.11)
AM	38.2	—

Rating group 7S

	Percent in rating	Coefficient estimates
BT	19.8	-0.022 (0.092)
CM	2.8	0.76 (0.15)**
EM	11.0	0.15 (0.10)
EN	21.3	0.46 (0.080)**
GM	10.9	0.76 (0.091)**
GS	1.3	0.49 (0.22)*
IC	1.7	0.20 (0.21)
IM	1.4	0.82 (0.20)**
MN	0.9	0.80 (0.24)**
OM	1.0	0.60 (0.24)*
MM	28.04	—

TABLE C-2 (Continued)

	Rating group 8			*Rating group 9*	
	Percent in rating	Coefficient estimates		Percent in rating	Coefficient estimates
BU	5.8	-0.13	PR	16.0	0.10
		(0.15)			(0.14)
CE	2.1	-0.24	SH	3.7	-0.30
		(0.26)			(0.31)
EO	5.9	-0.24	MS	80.3	—
		(0.15)			
LI	0.2	-1.40		*Rating group 10*	
		(1.05)			
ML	1.4	0.027		Percent in rating	Coefficient estimates
		(0.28)			
MR	4.9	0.16	AN	23.1	-0.40
		(0.15)			(0.12)**
PM	0.5	0.37	CN	0.1	1.10
		(0.40)			(1.26)
SW	1.1	0.099	FN	19.9	-0.28
		(0.30)			(0.12)*
UT	2.4	0.17	SN	56.9	—
		(0.21)			
HT	75.5	—			

TABLE C-3

LIKELIHOOD RATIO TEST FOR GEOGRAPHIC VARIATION IN *WRES* COEFFICIENT

Rating group	Value of log-likelihood function Unconstrained	Constrained	Likelihood ratio
1	-4086.0	-4089.8	7.5
2	-4318.0	-4323.7	11.4
3	-6500.3	-6503.9	7.0
4	-5299.6	-5306.4	13.5
5	-450.0	-456.1	11.2
6	-2308.2	-2316.8	16.8*
7A	-6009.5	-6014.4	9.9
7S	-4830.9	-4834.7	7.5
8	-3089.9	-3092.3	4.8
9	-1442.3	-1444.1	3.5
10	-1758.4	-1763.9	10.8

Table C-3 gives the results of testing the hypothesis that the coefficient on *WRES* varied across census regions. This test was performed by including interaction terms between *WRES* and the eight census regions. This provided the unconstrained maximum likelihood estimators for the likelihood ratio test described above. The constrained maximum likelihood estimators are those reported in tables C-1 and C-2, where the interaction terms were jointly restricted to have coefficients equal to zero. The likelihood ratio test is asymptotically distributed χ^2_8, with critical values of 15.507 at the 5-percent confidence level and 20.090 at the 1-percent confidence level. Including the pay interaction terms increased the value of the log-likelihood function significantly in only 1 of the 11 rating groups.